

GHEE- घृत The Holy Grail of OTC Market



Karan Dokras
&

Dr Uday Dokras

B.Sc., B.A.(Managerial Economics), LLB. Nagpur University, India

Graduate Studies, Queen's University, Canada

MBA (CALSTATE, USA)

Graduate Diploma in Law, Stockholm University, Sweden

Ph.D (Management) Stockholm University, Sweden

CONSULTANT- Gorewada International Zoo, Nagpur, India- Largest Zoo and Safari in Asia

1. O Agni-and-Vishnu, great [is] that greatness of yours; ye drink of the ghee that is called secret, assuming seven treasures in each house; may your tongue move on to meet the ghee.

2. O Agni-and-Vishnu, great [is] your dear domain (dhāman); ye partake of (vī) the ghee, enjoying secret things, increasing by good praise in each house; may your tongue move up to meet the ghee.

Atharva-Veda Samhita/Book VII/Hymn 29 (30)

He is joined with ghrīta . His womb (on the altar) is ghrīta. He rests on ghrīta. His abode is ghrīta. Carry hither (the gods) according to thy wont! Rejoice ! Carry, O bull, the offering, over which the Svāhā has been spoken, (to the gods).p. 200 **MANDALA II, HYMN 3.ASHTAKA II, ADHYĀYA 5, ARGHA 22-23.ĀPRĪ HYMN.**

SYNOPSIS

Ghee is making a comeback in the Ayurvedic and OTC market, medicines, health foods, foods in general and home cooking-which runs into several billion dollars. Spurred on by urbanization, rise of vegetarianism worldwide, rise of income levels and online marketing trends the world has finally recognized the value of Ayurveda in General and Ghee in particular. When we began to write about Ayurveda we also focussed our telescope on Ghee. One of us, Karan Dokras is working for a company that is marketing Ghee and finding out new and intrinsic blends, packaging ideas and markets.

Ghee is an enormous subject and so we decided to write three papers. The first, this one, is about Ghee in general, the second -about its marketing and the third short one about customization of Ghee.

This, then, is an introduction to a food item that is extremely romantic probably the most romantic in the world and the use and practices-not to mention myths and mythology of this product dates million year in the past. Welcome dear reader to this first part and don't miss the subsequent ones.

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INTRODUCTION: The very first solid food a mother feeds a baby in many Hindu households is mashed-up rice mixed with a little ghee. In recent years, ghee has become a global phenomenon, trending as a “superfood” and beloved by followers of the popular Keto diet. But its history- real and legendary is long. Ghee originated in India, where the heat was not conducive to storing butter for long periods. But when that butter was clarified-heated until the water evaporates and the milk solids separate away the product had a long shelf life. For thousands of years, ghee has been featured in Indian recipes, and even in Hindu mythology, which attributes its origins to the divine. Food fried in ghee (butter which has been boiled to remove its impurities) was particularly valued. It was classed as ‘pakka’, meaning it is cooked, stable and pure. Conversely, ‘kacha’ food is vulnerable and subject to impurities. Today too, ‘pakka’ food prepared with ghee is seen as festive and delicious, served as a sign of hospitality or given as a gift. Ghee is also recommended in traditional ayurvedic medicine to facilitate digestion and, when applied to the skin, to treat burns.

Ghee has also been venerated through the ages for its medicinal properties in Ayurvedic medicine, which prescribes it as a cooling food (it lowers the body’s temperature), as a digestive aid, and even as a salve to soothe burns. In “A Historical Dictionary of Indian Food,” K.T. Achaya writes that ghee is “strengthening, aids digestion, and acts quite powerfully on the mind, improving the memory and intellect.” That’s not all. Ghee is also high in butyrate, which reduces inflammation in the body, and it is also rich in vitamin A. It is also perfect for people who are lactose intolerant because hardly any of the butter’s lactose or casein remains.

The United States has a particularly amusing history with ghee. In the 1950s, upon discovering that American dairy farmers had more than 260 million pounds of surplus butter, the government had a novel idea: Convert the butter into ghee, and offload it onto the Indian subcontinent, where millions of people adore the stuff. The government took this prospect so seriously that dairy expert Louis H.

Burgwald was dispatched to India, where he dutifully peddled the American ghee and got merchants to sample his wares. The first lesson that he learned was that tastes for ghee varied across the length and breadth of the subcontinent. The ghee preferred in the south and the west (ghee made from the milk of cows) varied vastly from the ghee preferred in the north and the east (ghee made from buffalo milk). Burgwald was enthusiastic, though, and reported back to his bosses that if regional tastes could be catered to, then the Indian subcontinent was ripe for the picking. Eventually, nothing came of the undertaking.

Mythology: The story goes that Prajapati, lord of the creatures, rubbed his hands together to create the first ghee, which he then poured into flames to create his offspring. As a result, ghee is poured into sacred fires by Hindus to this day, a practice thought to be auspicious for marriages, funerals and other ceremonies. It was also extensively consumed as part of a balanced diet. Ancient Sanskrit literature describes ghee as fit for the gods. Modern Indian cooking no longer differentiates in kaccha and Pacca this way, but the practice is carried on in religious ceremonies and cooking for festivals such as the Hindu festival called Navratri.

This is the secret name of Butter:

"Tongue of the gods," "navel of immortality."

We will proclaim the name of Butter;

We will sustain it in this sacrifice by bowing low.

These waves of Butter flow like gazelles before the hunter...

Streams of Butter caress the burning wood.

Agni, the fire, loves them and is satisfied. Rg Veda (circa 1500 BC) in praise of ghee

Dairy products are granted special status in Hinduism. According to Hindu mythology, the universe and the earth were created from the churning of an ocean of milk. The anthropologist Marie-Claude Mahias believes that the mention of transforming milk into butter in the Hindu creation myth illustrates a process of ‘setting the world in order out of the original chaos’. Milk, yoghurt and ghee (from the Sanskrit ghr̥tá meaning ‘clarified butter’) have long since been used as an offering on altars and likened to the food of the gods. The consumption of milk, yoghurt and ghee has been part of the daily Indian diet since the first millennium BCE.¹

The lamp has its own special place in Sanātan Vaidik Hindu Dharma. It is a form and a symbol of Tēj (Absolute fire principle). The lamp is invoked as, ‘तमसो मा ज्योतिर्गमय ।’ meaning the lamp leads us from darkness towards light. It burns only to give the message of peace and light to man. That is its greatness. Amongst the articles of pūjā the lamp is an important article. The following mantra which is recited during the ritual of pūjā explains its significance.

भोदीपब्रह्मरूपस्त्वं ज्योतिषांप्रभुरव्ययः ॥
आरोग्यं देहि पुत्रांश्च मतः शान्तिं प्रयच्छ मे ॥

Meaning: O Deity of lamp, you are of the form of Brahman (the absolute truth). You are full of radiance. You never wither. Please bestow me health and good progeny and please fulfil my wishes. The bhog offered to the gods is mostly milk and fruit. Are these their favourite foods or is there some other reason behind it? The explanation is as follows: The earth is known as Vasundhara, that which holds up vasu, or plants. So if the earth is a cow, plants are its milk. In the Vedas, milk is given a lot of importance. Ghee, a milk product, is offered during yagnas to Agni, said to be the hunger of the gods.

Panchamruta contains five milk products — milk, both raw and boiled, ghee, butter and yoghurt. Go-ras, cow urine, honey and jaggery are all mixed in and offered to the gods. In the Puranas, it is said that Vishnu lies on Kshir Sagar, an ocean of milk. So, nature, prakriti, is visualised as an ocean of milk. Whatever you get from nature is like milk — that's the analogy. Which is why gods are always offered milk.

Ghee as foods of Shiva and Vishnu?

One way of looking at it is that Shiva is a vairagi, a tapasvi who wishes to stay away from domestic life, while Vishnu, in the form of Rama or Krishna, lives a householder's life. So Shiva is offered raw unprocessed milk and Vishnu, processed milk products like butter and ghee. Shiva is content with whatever is available. But because Vishnu is a householder, his offerings require effort; he needs manufactured products. To extract the butter from the milk, you have to put in a lot of work, or you will not see results. A lot of value is accorded to shram, labour. So, typically, Vishnu is offered cooked food.

During the Annakuta festival around Diwali, Krishna is offered a mountain of food, the chhappan bhog, or fifty-six items — because food is extremely important for a householder. The food offered matches the lifestyle of the god and it is made from Ghee.² Ghee lamp has more capacity to attract the *sattvik* vibrations present in the surrounding atmosphere as compared to oil lamp. It is believed that the oil lamp can attract the *sattvik* vibrations spread over a maximum distance of 1 meter while the ghee lamp can attract *sattvik* vibrations spread over till *Swarga Lok* (heaven). It is said and believed that only Pure Cow Milk Desi Ghee should be used for Puja and other rituals. The word itself 'Abhishekam' or Abhishek is a Sanskrit term that literally means to wet around and involves the ritual bathing of consecrated images. In the Bhakti devotional traditions, temple worship forms a central practice. Hindus regard the different *murthis* (sacred images) as living manifestations of Divinity. Devotees meditate upon the murthis and honour them with mantras or hymns. The murthis are regularly served through

different ceremonies such as Abhishekam. Ritual worship is an opportunity for the devotee to express one's love for their deity. It is a chance to physically interact with God, to relate to him on an intimate human level.

SPIRITUAL BENEFITS OF ABHISHEKAM

Generally, there are five main items which are used to bathe the consecrated image:

- Milk (Water) (taste)
- Yoghurt (Earth) (touch)
- Ghee (Fire) (sight)
- Honey (Ether) (hearing)
- Sugar (Air) (smell)

These five together are known as the 'Panchamritam' or the five nectars. Each of them is linked to one of the five elements and indeed one of the five senses. The five elements form the substratum of this material existence and the five senses dictate how we all individually perceive it. When devotees offer the Panchamritam, they are essentially asking Divinity to purify and balance the external physical world around as well as their own subjective perception of it. When each item is poured over the image there is a vibrational effect which transforms the surrounding environment as well as the individuals who are witnessing it. This is why Abhishekam is not just beneficial to the performer, but also to anyone who is present in the congregation. The positivity and spiritual energy created effortlessly uplifts everyone who attends the ceremony.

The Significance of Abhishekam

1. Abhishekam is the ritualistic washing of the idols of the Gods with substances considered to be sacred. Abhishekam can be quite simple when it's done with water or quite elaborate as in the case of Panchamrit Abhishekam.
2. The process of Abhishekam can be seen as sacrifice or penance to the Gods, by the offering of items like milk, ghee, honey etc. This is done to appease the Gods so we can gain their blessings in our lives.
3. It is an age-old practice that has been going on since the early days of Hinduism. Many religious scriptures highlight the importance of observing the Abhishekam rituals, aimed to please the Gods.
4. The pouring of items on God's idols signifies the devoted affection a bhakt has for his God. The souls of the devotees or priests who participate in this ritual with a pure heart and a clear conscience can get great improvement in their lives, by the grace of God.
5. Drinking the water or milk of Abhishekam after it has washed the lotus feet (or lingam) of God is considered extremely holy in Hinduism. Devotees line up for a few drops of this heavenly nectar after pooja ceremonies, at temples or at their homes.

6. Panchamrit Abhishekam of Lord Shiva is one of the main ways of worshipping the Shiva Linga. It can bring tremendous good luck and prosperity to the material and spiritual lives of devotees, and by Lord Shiva's grace can even save them from all obstacles in their lives.

7. Abhishekam is crucial to any pooja ceremony as much as the chanting of mantras and the performance of aarti. It is also a practice that is unique to Hinduism

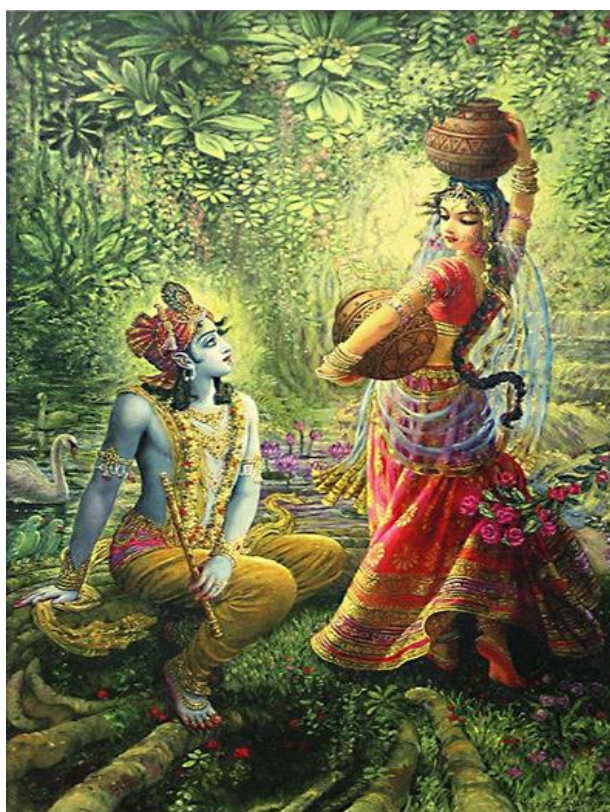
THE OUTER AND INNER EXPERIENCE OF ABHISHEKAM

Apart from a strong metaphysical effect, Abhishekam creates a strong devotional connection. To those who deeply absorb what is happening, every act that is outwardly performed is happening on an inner level. When we welcome the deity by washing His feet, that same deity is being welcomed into our hearts. When we honour Him by bathing Him in the Panchamritam, this too is happening within. The outside events become a deep meditation which profoundly nurtures our loving relationship with God. Divinity is no longer a distant reality but instead becomes an intimate and deep experience.

The life of Sri Krishna

In 3228 BCE in Mathura, India, a child was born who was destined to reshape the spiritual and temporal destiny of mankind—Sri Krishna. In his 125 years of life, Sri Krishna made an indelible impression upon mankind's collective consciousness—re-educating the world about devotion and dharma as well as the ultimate reality. His life was a model for people in days past, the modern world and surely for those in ages to come. Krishna, in fact, took birth in a prison cell. A sage had told his egoistic uncle, King Kamsa, that he would be killed by his sister Devaki's child. So Kamsa imprisoned Devaki and had each child she bore murdered. However, Devaki, and her husband, Vasudeva, finally were able to sneak one child off to safety. This was Sri Krishna. They sent Krishna off to Vraja, where he was raised by a foster mother, Yasoda. It was in Vrindavan, one of the villages of Vraja, that Krishna won the hearts of the gopis, the cowherds of the village. "By spending all his time with the gopis of Vrindavan—playing with them, joking with them, stealing their butter and milk, etc—what he actually was doing was stealing their hearts. The teachings of Krishna consciousness emphasize the many transcendental benefits of milk. The Vedas say the cow is one of the mothers of mankind; cow's milk and its many preparations are a key part of the recommended diet for human beings. Milk is considered essential for the proper development of the human brain, enhancing our ability to understand and apply spiritual knowledge.

Srila Prabhupada, founder-*acharya* of the International Society for Krishna Consciousness, was aware of the exploitative nature of the modern dairy industry. In his books and lectures, he repeatedly condemned the slaughterhouse economy as the crux of all the world's problems and urged his followers to establish self-sufficient, agrarian economies centered on cow protection.



World total milk production in 2017

(including cow/buffalo/goat/sheep/camel milk)

Rank	Country	Production (1000 tonnes/year)	Share in Global Production
	World	827,884	100%
1	 India	176,272	21.29%
2	 United States	97,760	11.81%
3	 Pakistan	44,293	5.35%
4	 China	34,869	4.21%
5	 Brazil	33,742	4.08%
6	 Germany	32,695	3.95%
7	 Russia	31,177	3.77%
8	 France	25,260	3.05%
9	 New Zealand	21,372	2.58%

10	 Turkey	20,700	2.50%
11	 United Kingdom	15,256	1.84%
12	 Netherlands	14,544	1.76%
13	 Poland	13,702	1.66%
14	 Italy	12,027	1.45%
15	 Mexico	11,988	1.45%
16	 Ukraine	10,520	1.27%
17	 Uzbekistan	10,167	1.23%
18	 Argentina	10,097	1.22%
19	 Australia	8,800	1.06%
20	 Canada	8,100	0.98%

DAIRY: A dairy is a business enterprise established for the harvesting or processing (or both) of animal milk – mostly from cows or goats, but also from buffaloes, sheep, horses, or camels – for human consumption. A dairy is typically located on a dedicated dairy farm or in a section of a multi-purpose farm (mixed farm) that is concerned with the harvesting of milk. Milk producing animals have been domesticated for thousands of years. Initially, they were part of the subsistence farming that nomads engaged in. As the community moved about the country, their animals accompanied them. Protecting and feeding the animals were a big part of the symbiotic relationship between the animals and the herders. In the more recent past, people in agricultural societies owned dairy animals that they milked for domestic and local (village) consumption, a typical example of a cottage industry. The animals might serve multiple purposes (for example, as a draught animal for pulling a plow as a youngster, and at the end of its useful life as meat). In this case, the animals were normally milked by hand and the herd size was quite small, so that all of the animals could be milked in less than an hour—about 10 per milker. These tasks were performed by a *dairymaid* (*dairywoman*) or *dairyman*. The word *dairy* harkens back to Middle English *dayerie*, *deyerie*, from *deye* (female servant or dairymaid) and further back to Old English *dæge* (kneader of bread). With industrialization and urbanization, the supply of milk became a commercial industry, with specialized breeds of cattle being developed for dairy, as distinct from beef or draught animals. Initially, more people were employed as milkers, but it soon turned to mechanization with machines designed to do the milking.

Historically, the milking and the processing took place close together in space and time: on a dairy farm. People milked the animals by hand; on farms where only small numbers are kept, hand-milking

may still be practiced. Hand-milking is accomplished by grasping the teats (often pronounced *tit* or *tits*) in the hand and expressing milk either by squeezing the fingers progressively, from the udder end to the tip, or by squeezing the teat between thumb and index finger, then moving the hand downward from udder towards the end of the teat. The action of the hand or fingers is designed to close off the milk duct at the udder (upper) end and, by the movement of the fingers, close the duct progressively to the tip to express the trapped milk.

India has come a long way in the field of dairy from being in deficit from 20mn MT IN 1970 to being the world's largest milk producing country at 160mn MT accounting for 18.5% of world production. In last 35 years, India's milk production outstripped with 4.5% CAGR as against ~1.6% CAGR posted by global milk Production. Going ahead, India's milk production is expected to outperform global production and grow at similar 4.2% CAGR to 185mn MT per annum/507mn litres per day and surpass EU to emerge the largest dairy producer by 2020 and improve in value terms at ~15% CAGR to INR 9.4tn over FY16-20.

Key Structural Trends & Drivers of this dairy market are:

1. *Rising per capita income:* India is the world's largest consumer of dairy products, consuming almost 100% of its own milk production. Despite being the world's largest consumer, per capita milk consumption (PCC) in India is 97 litres/year, significantly trailing USA, EU27, Russia Federation and Brazil.
2. *India's per capita milk consumption* increasing at 3% CAGR versus 1% CAGR globally. At 97 litres per year it significantly trails its global peers. There exists enormous scope for India's per capita milk consumption to spurt led by growth in value-added products (VADP), which is at 34% of industry versus 86% for the global mature markets like EU.
3. *Vast vegetarian population:* Latent growth potential for India's dairy industry is huge.
4. *Rising share of organised sector:* Led by rising disposable income, and growing consumer preference for branded and value-added milk & milk products, investments by organised players in the sector has been on the rise. The organised players are set to grow at 20% CAGR over 2016-20 outpacing industry growth of 15% CAGR, and enhance share in the Indian dairy industry to 26% from 22% in 2016.
5. *VADP* has been gaining importance with increasing changes in India's demographic and dietary patterns. In medium term, while demand for branded milk is expected to grow by 15% CAGR, VADP would grow even stronger by 20% plus CAGR driven by increasing share of organised sector.

Ghee and SMP (Solid milk products): Excess supply of milk from the farmers by dairies is accepted and converted into longer shelf-life products such as skimmed milk powder and milk fats. 1 litre of Cow's milk has 3 components-3.5%fat, 7.5 % SNF and water. When any company sells standard milk, it sells milk with 3- 4 % fat and saves some fat for the manufacture of ghee and butter. Ghee can be sold in bulk at ~5% margins. 24-28% gross margins are possible to be achieved on Ghee. Even though this is less than the 40% on Whey products, still the whey market is in its infancy in India.

EDELWEISS Report on India- Dairy.

Structural levers to script multi-year growth story

The domestic dairy industry is poised to embark on the growth super highway- CAGR of 15% over FY16-

20. We believe structural growth levers are in place to fuel this spurt: wherein: a) Mere 22% (INR1.19trillion) organised pie is set to catapult 2 times, primarily driven by fresh dairy products (milk, curd, Ghee, paneer, etc) clocking 20% CAGR over FY16-

20E; b) Urbanisation is driving strong 2.5x surge in VADP, spearheaded by high-margin emerging categories like cheese, whey, UHT and flavoured milk logging ~25% CAGR versus liquid milk's 15% CAGR over FY16-

20E; and c) There's a large vegetarian population (31%) with rising income levels and sub-standard protein consumption

December 1, 2017 December 1, 2017 Crème de la crème: Milking the value chain

There are millions of quotes about Ghee in the Holy texts. In the Mahabharata, the Kauravas were born from pots of ghee and no other substance is as widely used to prepare Ayurvedic medicines as ghrīta as Ghee is fondly called in Sanskrit. Ghee is a class of clarified butter that originated in ancient India. The word *ghee* comes from Sanskrit: घृत 'clarified butter', from *ghṛ-* 'to sprinkle'. It is commonly used in Middle Eastern cuisine also; cuisine of the Indian subcontinent, Southeast Asian cuisine, traditional medicine, and religious rituals. Ghrīta is also cited as the best substance for preparing the body for Ayurveda's internal detoxification (Panchakarma). It is widely used in medicinal formulations due to its unusual ability to assimilate the properties of herbs it is mixed with, without losing its own qualities. Ghee is common in cuisines from the Indian subcontinent. Particularly the satwik type of food prepared in almost temples use ghee as a major ingredient for their culinary skills. Ghee is widely used in South Indian cuisine for tempering curries, in preparation of rice dishes and sweets. South Indians have a habit of adding ghee to their rice before eating it with pickles and curries. South Indians are one of the biggest consumers of ghee. Ghee is an ideal fat for deep frying because its smoke point (where its molecules begin to break down) is 250 °C (482 °F), which is well above typical cooking temperatures of around

200 °C (392 °F) and above that of most vegetable oils. Ayurveda considers pure ghee to be *sāttvik* or *sattva-guṇi* (in the "mode of goodness"), when used as food. It is the main ingredient in some of the Ayurvedic medicines, and is included under *catuh mahā sneha* (the four main oils: *ghṛta*, *taila*, *vasā*, and *majjā*) along with sesame oil, muscle fat, and bone marrow. Though eight types of ghee are mentioned in Ayurvedic classics, ghee made of human breast milk and cow's ghee are favored. Ghee is also used in Ayurvedas for constipation and ulcers. To understand Ghee better we need to focus on it's mother-*Butter*.

History of Butter

Named for its bright yellow color, ghee is more than just butter. This clarified cooking fat was most likely used to fuel lamps and heal skin ailments, but over time found its way to the plate – and that's a very good thing. Ghee is, according to Hinduism, a true food of the gods. It's loaded with health benefits, dripping with culinary flavor, and the perfect fat for diabetics. Around a 1,000 year ago, butter was discovered by humans hauling milk from one place to another in skin bags around central Asia. This and then churned milk (cream) turned to butter. In India, the hot climate made it necessary to preserve the butter some way so someone heated it into Ghee.

Butter – A Universal Food?: Early humans ate what they could, where they could find it. Most of our ancestors started out as hunter gatherers, and passed through a pastoralist phase before finally settling down and practicing agriculture. The pastoralist phase was more important than you might realize. It diversified our dairy consumption to a great extent – foods like yogurt, cheese, and butter came out of this period. Butter production most likely began by accident. A shepherd, with a skin bag of goat, sheep, yak, cow, camel, or other milk, spent a little too much time letting that bag bang around in the heat before opening it for a drink. When the time came for a drink, the contents of the bag weren't milk anymore... they were butter. Around the world, butter has hundreds of names, and is enjoyed in the majority of cultures. It's a nearly universal food.

Modern Alternative Medicine

From the days of its initial discovery, butter has been used as a topical ointment it has many health qualities and is one of the healthiest of saturated fats, but ghee's benefits are better than butter's. The majority of clarified butters in the world remove milk fats and solids in the early stages of production. Ghee leaves them in, adding a nutty flavour to the final product, and there's one extra benefit that the lactose and casein content is very little, since these components break down during the slow boiling that creates ghee. That makes it a great substitute for people with lactose or casein sensitivities.

Like all fats, if you overdo it, your health will suffer. For a healthy diet, it's a great pick, though. It has a higher smoke point than most cooking fats, making it a little healthier from the get-go. Rich in butyrate, it eases digestion and reduces inflammation in the body. One tablespoon is equal to 15% of your daily recommended intake of Vitamin A, and the conjugated linoleic acid (CLA) in ghee is thought to be a potent cancer fighter. There's a chance that CLA also helps insulin resistance, making this a smart choice for diabetics and prediabetics, too. A moisturizer, helps heal burns, and is great for dry hair or as a conditioning mask? Just remember, the majority of the benefits offered by ghee disappear if it's not made with milk from grass-fed cows.

Butter is an ancient food, and ghee is nearly as old. In many parts of the world where it is actively used in culinary and medicinal preparations, this clarified butter goes by the traditional Indian name. Its health benefits are quickly coming to light, and as we experiment with more and more ghee recipes, modern alternative and natural medicine is also reconnecting with this super fat.

The earliest butter would have been from sheep or goat's milk; cattle are not thought to have been domesticated for another thousand years. An ancient method of butter making, still used today in parts of Africa and the Near East, involves a goat skin half filled with milk, and inflated with air before being sealed. The skin is then hung with ropes on a tripod of sticks, and rocked until the movement leads to the formation of butter.

In the Mediterranean climate, unclarified butter spoils quickly— unlike cheese, it is not a practical method of preserving the nutrients of milk. The ancient Greeks and Romans seemed to have considered butter a food fit more for the northern barbarians. A play by the Greek comic poet Anaxandrides refers to Thracians as *boutyrophagoi*, butter-eaters. In his *Natural History*, Pliny the Elder calls butter "the most delicate of food among barbarous nations", and goes on to describe its medicinal properties. Later, the physician Galen also described butter as a medicinal agent only.

Historian and linguist Andrew Dalby says most references to butter in ancient Near Eastern texts should more correctly be translated as ghee. Ghee is mentioned in the *Periplus of the Erythraean Sea* as a typical trade article around the first century CE Arabian Sea, and Roman geographer Strabo describes it as a commodity of Arabia and Sudan.



God of Hindus KRISHNSA and his affection for butter

Middle Ages

In the cooler climates of northern Europe, people could store butter longer before it spoiled. Scandinavia has the oldest tradition in Europe of butter export trade, dating at least to the 12th century. After the fall of Rome and through much of the Middle Ages, butter was a common food across most of Europe—but had a low reputation, and so was consumed principally by peasants. Butter slowly became more accepted by the upper class, notably when the early 16th century Roman Catholic Church allowed its consumption during Lent. Bread and butter became common fare among the middle class, and the English, in particular, gained a reputation for their liberal use of melted butter as a sauce with meat and vegetables. In antiquity, butter was used for fuel in lamps as a substitute for oil. The *Butter Tower* of Rouen Cathedral was erected in the early 16th century when Archbishop Georges d'Amboise authorized the burning of butter instead of oil, which was scarce at the time, during Lent.

Across northern Europe, butter was sometimes treated in a manner unheard-of today: it was packed into barrels (firkins) and buried in peat bogs, perhaps for years. Such "bog butter" would develop a strong flavour as it aged, but remain edible, in large part because of the unique cool, airless, antiseptic and acidic environment of a peat bog. Firkins of such buried butter are a common archaeological find in Ireland; the National Museum of Ireland – Archaeology has some containing "a greyish cheese-like substance, partially hardened, not much like butter, and quite free from putrefaction." The practice was most common in Ireland in the 11th–14th centuries; it ended entirely before the 19th century.

Industrialization

Like Ireland, France became well known for its butter, particularly in Normandy and Brittany. By the 1860s, butter had become so in demand in France that Emperor Napoleon III offered prize money for an inexpensive substitute to supplement France's inadequate butter supplies. A French chemist claimed the prize with the invention of margarine in 1869. The first margarine was beef tallow flavoured with milk and worked like butter; vegetable margarine followed after the development of hydrogenated oils around 1900.



Gustaf de Laval's centrifugal cream separator sped up the butter-making process.

Until the 19th century, the vast majority of butter was made by hand, on farms. The first butter factories appeared in the United States in the early 1860s, after the successful introduction of cheese factories a decade earlier. In the late 1870s, the centrifugal cream separator was introduced, marketed most successfully by Swedish engineer Carl Gustaf Patrik de Laval. This dramatically sped up the butter-making process by eliminating the slow step of letting cream naturally rise to the top of milk. Initially, whole milk was shipped to the butter factories, and the cream separation took place there. Soon, though, cream-separation technology became small and inexpensive enough to introduce an additional efficiency: the separation was accomplished on the farm, and the cream alone shipped to the factory. By 1900, more than half the butter produced in the United States was factory made; Europe followed suit shortly after. In 1920, Otto Hunziker authored *The Butter Industry, Prepared for Factory, School and Laboratory*, a well-known text in the industry that enjoyed at least three editions (1920, 1927, and 1940). As part of the efforts of the American Dairy Science Association, Professor Hunziker and others published articles regarding: causes of tallowiness (an odour defect, distinct from rancidity, a taste defect); mottles (an aesthetic issue related to uneven colour); introduced salts;¹ the impact of creamery metals and liquids; and acidity measurement. These and other ADSA publications helped standardize practices internationally.

Butter also provided extra income to farm families. They used wood presses with carved decoration to press butter into pucks or small bricks to sell at nearby markets or general stores. The decoration identified the farm that produced the butter. This practice continued until production was mechanized and butter was produced in less decorative stick form. Today, butter presses remain in use for decorative purpose. There has been a decline in most western nations during the 20th century in consumption of

butter, due to popularity of margarine, -less expensive and - healthier. In the United States, margarine consumption overtook butter during the 1950s, and it is still the case today that more margarine than butter is eaten in the U.S. and the EU.

Packaging-India

In India, butter has traditionally been made into small, rectangular blocks by means of a pair of wooden butter paddles. It is usually produced in 250 gram bars and 500 gram blocks that are individually wrapped in waxed or foiled paper, and sold. This practice is believed to have originated in The USA in 1907, when Swift and Company began packaging butter in this manner for mass distribution. Due to historical differences in butter printers (machines that cut and package butter), in the USA 4-ounce sticks are commonly produced in two different shapes: Butter for commercial and industrial use is packaged in plastic buckets, tubs, or drums, in quantities and units suited to the local market.

WORLD BUTTER PRODUCTION

Rank	Country	Production (1000 MT)	
1	India	5,850	
2	EU-27	2,360	
3	United States	861	
4	New Zealand	540	
5	Russian Federation	275	
6	Mexico	230	
7	Canada	125	
8	Belarus	118	
9	Ukraine	103	
10	Brazil	86	
11	Australia	75	
12	Japan	61	
13	Argentina	44	

Different varieties are found around the world. *Smen* is a spiced Moroccan clarified butter, buried in the ground and aged for months or years. A similar product is *maltash* of the Hunza Valley, where cow and yak butter can be buried for decades, and is used at events such as weddings. Yak butter is a specialty in Tibet; *tsampa*, barley flour mixed with yak butter, is a staple food. Butter tea is consumed in the Himalayan regions of Tibet, Bhutan, Nepal and India. It consists of tea served with intensely flavored—or "rancid"—yak butter and salt. In African and Asian developing nations, butter is

traditionally made from sour milk rather than cream. It can take several hours of churning to produce workable butter grains from fermented milk.^[40]

Storage and cooking

Normal butter softens to a spreadable consistency around 15 °C (60 °F), well above refrigerator temperatures. The "butter compartment" found in many refrigerators may be one of the warmer sections inside, but it still leaves butter quite hard. Until recently, many refrigerators sold in New Zealand featured a "butter conditioner", a compartment kept warmer than the rest of the refrigerator—but still cooler than room temperature—with a small heater.^[41] Keeping butter tightly wrapped delays rancidity, which is hastened by exposure to light or air, and also helps prevent it from picking up other odours. Wrapped butter has a shelf life of several months at refrigerator temperatures. Butter can also be frozen to further extend its storage life.

"French butter dishes" or "Acadian butter dishes" have a lid with a long interior lip, which sits in a container holding a small amount of water. Usually the dish holds just enough water to submerge the interior lip when the dish is closed. Butter is packed into the lid. The water acts as a seal to keep the butter fresh, and also keeps the butter from overheating in hot temperatures. This method lets butter sit on a countertop for several days without spoiling.

Once butter is softened, spices, herbs, or other flavouring agents can be mixed into it, producing what is called a *compound butter* or *composite butter* (sometimes also called *composed butter*). Compound butters can be used as spreads, or cooled, sliced, and placed onto hot food to melt into a sauce. Sweetened compound butters can be served with desserts; such hard sauces are often flavoured with spirits. When heated, butter quickly melts into a thin liquid. Melted butter plays an important role in the preparation of sauces, most obviously in French cuisine. *Beurre noisette* (hazelnut butter) and *Beurre noir* (black butter) are sauces of melted butter cooked until the milk solids and sugars have turned golden or dark brown; they are often finished with an addition of vinegar or lemon juice. Hollandaise and béarnaise sauces are emulsions of egg yolk and melted butter; they are in essence mayonnaises made with butter instead of oil. Hollandaise and béarnaise sauces are stabilized with the powerful emulsifiers in the egg yolks, but butter itself contains enough emulsifiers—mostly remnants of the fat globule membranes—to form a stable emulsion on its own. *Beurre blanc* (white butter) is made by whisking butter into reduced vinegar or wine, forming an emulsion with the texture of thick cream. *Beurre monté* (prepared butter) is melted but still emulsified butter; it lends its name to the practice of "mounting" a sauce with butter: whisking cold butter into any water-based sauce at the end of cooking, giving the sauce a thicker body and a glossy shine—as well as a buttery taste.

In Poland, the butter lamb (*Baranek wielkanocny*) is a traditional addition to the Easter Meal for many Polish Catholics. Butter is shaped into a lamb either by hand or in a lamb-shaped mould. Butter is also used to make edible decorations to garnish other dishes. Butter is used for sautéing and frying, although

its milk solids brown and burn above 150 °C (250 °F)—a rather low temperature for most applications. The smoke point of butterfat is around 200 °C (400 °F), so clarified butter or ghee is better suited to frying. Ghee has always been a common frying medium in India, where many avoid other animal fats for cultural or religious reasons. Butter fills several roles in baking, where it is used in a similar manner as other solid fats like lard, suet, or shortening, but has a flavour that may better complement sweet baked goods. Many cookie doughs and some cake batters are leavened, at least in part, by creaming butter and sugar together, which introduces air bubbles into the butter. The tiny bubbles locked within the butter expand in the heat of baking and aerate the cookie or cake. Some cookies like shortbread may have no other source of moisture but the water in the butter. Pastries like pie dough incorporate pieces of solid fat into the dough, which become flat layers of fat when the dough is rolled out. During baking, the fat melts away, leaving a flaky texture. Butter, because of its flavour, is a common choice for the fat in such a dough, but it can be more difficult to work with than shortening because of its low melting point. Pastry makers often chill all their ingredients and utensils while working with a butter dough.

As butter is essentially just the milk fat, it contains only traces of lactose, so moderate consumption of butter is not a problem for lactose intolerant people. People with milk allergies may still need to avoid butter, which contains enough of the allergy-causing proteins to cause reactions. Whole milk, butter and cream have high levels of saturated fat. Butter is a good source of Vitamin A.

Named for its bright yellow colour, ghee is more than just butter. This clarified cooking fat was most likely used to fuel lamps and heal skin ailments, but over time found its way to the plate – and that’s a very good thing. Ghee is, according to Hinduism, a true food of the gods. It’s loaded with health benefits, dripping with culinary flavour, and the perfect fat for diabetics. Around a 1,000 year ago, butter was discovered by humans hauling milk from one place to another in skin bags around central Asia. This and then churned milk (cream) turned to butter. In India, the hot climate made it necessary to preserve the butter some way so someone heated it into Ghee.

Butter – A Universal Food? Early humans ate what they could, where they could find it. Most of our ancestors started out as hunter gatherers, and passed through a pastoralist phase before finally settling down and practicing agriculture. The pastoralist phase was more important than you might realize. It diversified our dairy consumption to a great extent – foods like yogurt, cheese, and butter came out of this period. Butter production most likely began by accident. A shepherd, with a skin bag of goat, sheep, yak, cow, camel, or other milk, spent a little too much time letting that bag bang around in the heat before opening it for a drink. When the time came for a drink, the contents of the bag weren’t milk anymore... they were butter. Around the world, butter has hundreds of names, and is enjoyed in the majority of cultures. It’s a nearly universal food.

Enter the Ghee

The Asian subcontinent has a long-standing love affair with butter. In some parts of the region, the average life expectancy stretches well above 100 years of age, and the people are quick to credit the butter they use. In the northeast corner of the Indian subcontinent, sometime near 1800-2000 BCE, the need to carry butter for distances – probably for trade – led to the creation of shelf-stable butter. Ghee.

Ghee's creation took place in what is now the northeast corner of India, but its popularity bloomed somewhere else. Somewhere that milk would go rancid too quickly to use, and regular butter would be a useless puddle by midday. Southern India. The impact of this healthy and shelf-stable fat was so important that it soon found its way to a place you probably wouldn't expect.

This saturated fat gained a religious following.

Sacred Fat

In ancient India Ghee appears in Chapter 9 of the Bhagavad Gita, and in at least one of the hymns of Rig Veda from approximately 1500BCE. Dharma sutra law verses, a code that included religious and political requirements, ghee is mentioned as a key part of religious rituals.

Prajapati, the lord of creatures in Hindu mythology, created ghee when he rubbed his hands together to churn it. He poured the ghee into fire in order to create his offspring. As a result, many Hindus still reenact this gesture as a means of recreating creation. The religious impact of ghee in India stretches beyond the spiritual and mythological references and into practice. The caste system of India is strict and Hindu foods are divided by class. No one can eat food that someone of a lower caste prepares unless it is a "superior" food. One way to make even the most "inferior" foods into superior ones is to cook them in ghee. As a result, cooking in ghee is a great way for Hindu restaurant owners to ensure that clientele of all castes eat at their establishments. And in Ayurvedic medicine, ghee is used in special preparations with herbs for healing.

Modern Alternative Medicine

From the days of its initial discovery, butter has been used as a topical ointment. It has many health qualities and is one of the healthiest of saturated fats, but ghee's benefits are better than butter's. The majority of clarified butters in the world remove milk fats and solids in the early stages of production. Ghee leaves them in, adding a nutty flavour to the final product, and there's one extra benefit that the lactose and casein content is very little, since these components break down during the slow boiling that creates ghee. That makes it a great substitute for people with lactose or casein sensitivities.

Like all fats, if you overdo it, your health will suffer. For a healthy diet, it's a great pick, though. It has a higher smoke point than most cooking fats, making it a little healthier from the get-go. Rich in butyrate, it eases digestion and reduces inflammation in the body. One tablespoon is equal to 15% of your daily recommended intake of Vitamin A, and the conjugated linoleic acid (CLA) in ghee is thought

to be a potent cancer fighter. There's a chance that CLA also helps insulin resistance, making this a smart choice for diabetics and prediabetics, too. A moisturizer, helps heal burns, and is great for dry hair or as a conditioning mask? Just remember, the majority of the benefits offered by ghee disappear if it's not made with milk from grass-fed cows.

Butter is an ancient food, and ghee is nearly as old. In many parts of the world where it is actively used in culinary and medicinal preparations, this clarified butter goes by the traditional Indian name. Its health benefits are quickly coming to light, and as we experiment with more and more ghee recipes, modern alternative and natural medicine is also reconnecting with this super fat.

2 Types of traditional Ghees: There are two types of traditional ghee. One, as mentioned above, where yogurt is churned to make butter, and subsequently converted to ghee. The other comes from clotted cream, or malai, skimmed from the top of boiled milk, which is then churned into butter and heated to produce ghee. The latter is a common practice in several Indian households and as I remember, is how my mother and grandmother made ghee. Both these techniques can be traced back to our pastoral ancestors. They learned that by churning yogurt in a to-and-fro motion for a long enough duration, at the right temperature, they could extract butter. This trickled down to tropical plains where a hotter climate necessitated the boiling of milk to keep it from spoiling, which eventually led to the daily collection of readily available clotted cream.

Elsewhere in the world, fresh cream is separated from raw milk using a crankshaft system that spins milk at high speeds, separating the heavier skimmed-milk and allowing the lighter cream to drip down. Old-fashioned European churners didn't subscribe to the aggressive to-and-fro churning principle; instead they adopted the gentle and continuous aeration of cream, which, as any baker will tell you, is how over-whisked fresh cream becomes butter. Butter is actually a water-in-oil emulsion that typically is at least 80% fat, about 16-18% water, and 1-3% milk solids depending on the commercial brand of butter.

Salted butter has a longer shelf life than does unsalted butter. What this means, is that generally speaking, unsalted butter tends to be "fresher" than salted butter because it cannot stay on grocery store shelves for as long. In addition, the salt content of butter varies by brand, so it becomes harder to control the amount of salt that a baking recipe calls for. Since baking is an exact science, the lack of control can make it harder to manage the delicate balance of flavours that exist in many baked goods.

Melted butter: Melted or drawn butter is achieved by heating up butter so that it goes from solid into a liquid. The liquid form still retains the milk solids. This can be done in a sauce pan or a microwave, but care must be taken to not burn the butter. Melted butter should be done over low or medium heat, or else the milk solids will separate and burn the butter.

Creamed Butter: Creamed butter is a mixture of butter and sugar where the sugar acts to aerate or add air into the butter to achieve a fluffy consistency. Butter first is softened – often accomplished by leaving out in room temperature to have the butter to lose some of its firm structure and become “softened”.

Butter replace Creamed Butter and Vice Versa in a Recipe? The answer to this depends on what baked good you are cooking and what texture you are looking to accomplish. In general, creamed butter will lead to cakier textures as it introduces more air to the baking process than melted butter. Melted butter in comparison will be denser, and often times recipes calling for this will introduce another leavening agent to be the one adding air to a baked good.

Melted butter is often used in recipes that call for gentle mixing such as quick breads, brownies, muffins, cupcakes, pancakes etc. These recipes usually have a leavening agent such as baking powder or baking soda as part of the recipe. Creamed butter is often used in cakes, cookies, and other foods that have fluffier textures. That’s not to say that creamed butter or melted butter can’t be replaced, just that the difference in texture and incorporation of air is something that needs to be taken account of in order to do so.

Clarified Butter: Clarified butter is purified butterfat, where the milk solids and the water have been removed. This is often done by heating the butter in a saucepan to precisely the point where water evaporates. The milk solids are then filtered in a strainer lined with a cheesecloth. Clarified butter is more concentrated in flavour as a result of removing the water. An advantage of clarified butter in baking is that it has a high smoke point, which means the temperature it can be heated up to before it burns.

Browned Butter: Browned butter is a result of heating butter and letting it caramelize. Unlike ghee and clarified butter, the milk solids will caramelize and be retained for cooking or baking. Browned butter introduces what most people define as a “nutty caramel flavour”. Browned butter is a fairly potent flavour that can really elevate the flavours in a lot of baked goods. In comparison to butter, margarine has a higher water content and a lower fat content, which will greatly impact the flavour and texture of your baked goods. It is not recommended in baking because it can have a fairly sizable impact on your recipe.

Cocoa butter is not from cow’s milk and is instead the vegetable fat from cocoa beans. It is typically used in chocolates, but not ideal for baking as it has a low melting point.

The key difference here in India is that we have always struggled to separate fat (or cream) from milk, whether by the laborious churning of yogurt or by tedious collection of small portions of malai. But this struggle has inadvertently led to a far superior flavour. In both cases, fermentation plays a necessary

role in developing and nurturing these flavours of terroir(Earth) and releasing micronutrients that add depth and character to ghee.

Malai ghee has a gently fermented dairy flavour, resting on the sturdy notes of toffee, a result of the caramelisation of residual sugars in the malai. This nutty, brown-butter flavour is a joy to savour in tadkas. With yogurt ghee, the sugar content in butter is very low, and good yogurt ghee does not have these notes of caramelised sugar. With more sophisticated flavours brought about by secondary fermentation, yogurt ghee is a revelation yet to find its place in the spotlight.

Today's mass-produced store-bought ghee is another example of industrialised food. In order to control costs and minimize losses, large-scale dairies have adopted the European separation of fresh cream from milk, and now make ghee by directly heating this sugar-rich cream. With standardisation comes the predictability of flavour: a one-dimensional product that has been stripped bare of nuance. The fermented dairy flavour is notably absent, but customers still enjoy it for the nutty notes of caramel that have come to be associated with ghar ka ghee.

Comparative properties of common cooking fats (per 100 g)

Type of fat	Total fat (g)	Saturated fat (g)	Mono-unsaturated fat (g)	Poly-unsaturated fat (g)	Smoke point
1. Sunflower oil	100	11	20	69	225 °C (437 °F)
2. Sunflower oil (high oleic)	100	12	84	4	
3. Soybean oil	100	16	23	58	257 °C (495 °F)
4. Canola oil	100	7	63	28	205 °C (401 °F)

Comparative properties of common cooking fats (per 100 g)

Type of fat	Total fat (g)	Saturated fat (g)	Mono-unsaturated fat (g)	Poly-unsaturated fat (g)	Smoke point
5. Olive oil	100	14	73	11	190 °C (374 °F) ^[47]
6. Corn oil	100	15	30	55	230 °C (446 °F)
7. Peanut oil	100	17	46	32	225 °C (437 °F)
8. Rice bran oil	100	25	38	37	250 °C (482 °F)
9. Vegetable shortening (hydrogenated)	71	23	8	37	165 °C (329 °F)
10. Lard	100	39	45	11	190 °C (374 °F)
11. Suet	94	52	32	3	200 °C (392 °F)
12. Butter	81	51	21	3	150 °C (302 °F)
13. Coconut oil	100	86	6	2	177 °C (351 °F)

Ghee or clarified butter is a dairy product used widely in Indian cuisine. With about 171 thousand metric tons produced in fiscal year 2018, it was consumed mostly in the northern region of the country. Ghee is not such a bad thing to consume after all, but the health conscious Indian consumer wants more.

Enter organic ghee. This phrase basically means ghee churned out of milk derived from 'stress free' or 'happier' cows that are put on organic diet. Players in this niche category have seen huge surge in demand, with some of them clocking as much as 400 per cent growth in sales.

Off late, with rising awareness on different types of cholesterol and demand for ghee has seen an upsurge among urban consumers, especially cow ghee has been clocking a robust growth rate, almost double of that of buffalo ghee. Cow ghee is, however, just about 10 per cent of the Rs 10,000 crore Indian ghee market.

Niche players like Organic India, Vedic Cow and Holy Cow Foundation have tried to cater to a fast growing niche category here, organic cow ghee.

Lucknow-based Organic India has seen demand for its organic ghee grow manifold in the past four years since it launched. As Saurabh Tiwari, chief marketing officer of Organic India claims that the demand for organic ghee has grown by almost 400 per cent for them in the past four years, and this is when organic ghee costs at least 40-50 per cent more than conventional ghee.

What is organic ghee? It is ghee derived out of the milk from cows who are fed an organic diet. Some like Vedic Cow Products who run an online portal to sell indigenous items like khadi, food items like ghee, honey etc, claim that it is essential that the milk is sourced from 'stress-free' cows who are not only fed well but are also allowed to roam freely, feed their calves first. Nishant Khadria, the founder of Mumbai-based Vedic Cow Products said that the quality of the milk changes when cows are stressed, as the hormones that go into the milk change dramatically. He now sources his milk from only four to five 'gaushalas' or cow farms around Maharashtra, Rajasthan and Uttarakhand. The milk is converted into ghee at the gaushala itself, so that there is no need to refrigerate and preserve the milk.

"We only source from cows of Indian breed because ayurveda talks of benefits of ghee from Indian cows. And in the two years that we have started, we have noticed that despite selling at a strong premium (Vedic Cow's ghee is priced at Rs 1300 per kg as against Rs 450-500 a kg for conventional ghee), we continue to grow at 30 per cent year on year in terms of volumes and new customer acquisition," Khadria explained.

His firm has also started exporting to customers in the US, where people are trying to incorporate organic ghee as a part of their everyday diet.

Organic India too is business worth Rs 5-6 crore from organic ghee alone. It was selling around 1,000 bottles per month around four years back, and now it does around 14,000 bottles a month. Tiwari is vocal about the pesticide contamination which gets into our milk, and in turn, all milk products. Therefore, Organic India has ensured that the land on which these cows graze are certified organic. "It takes around three to four years to convert a land into organic. We add neem, cow dung etc apart from stopping usage of chemical pesticides altogether," he explained. Organic India is currently working with over 2,000 marginal farmers who have around 2 acre of average landholding.

It has also tied up with modern trade outlets to boost sales, however, now the company feels that there is more demand than it can supply. "We see an immediate demand of around Rs 15-20 crore for organic ghee alone from Organic India," Tiwari said. The Rs 200 crore company gets around 65 per cent of its revenues from organic tulsi, which it also exports outside India.

Brand experts feel that with the rise of the health conscious, there is demand for organic food, and ghee as a category is no exception. *First Published: Sat, May 21 2016, 13:37 IST. BUSINESS STANDARD*

In India, ghee has been a symbol of purity and an offering to the gods—especially Agni, the Hindu god of fire—for more than 3000 years; references to ghee's sacred nature appear numerous times in the *Rig-Veda*, circa 1500–1200 BCE. The tale of the child Krishna stealing butter remains a popular children's story in India today. Since India's prehistory, ghee has been both a staple food and used for ceremonial purposes, such as fuelling holy lamps and funeral pyres. Traditionally, ghee (Sanskrit: गोघृत, go-ghṛta) was and is always made from bovine milk, as cows are considered sacred, and it is a sacred requirement in Vedic *yajña* and *homa* (fire rituals), through the medium of Agni (fire) to offer oblations to various deities. Fire rituals have been performed dating back over

5,000 years. They are thought to be auspicious for ceremonies such as marriage, funerals, etc. Ghee is also necessary in Vedic worship of divine deities, with *aarti* (offering of ghee lamp) called *diyā* or *dīpa* and for *Pañcāmṛta* (Panchamruta) where ghee along with mishri, honey, milk, and curd is used for bathing the deities on the appearance day of Krishna on Janmashtami, *Śiva* (Shiva) on *Mahā-śivarātri* (Maha Shivaratri). There is a hymn to ghee.

“Ghrita is sweet in taste and cooling in energy, rejuvenating, good for the eyes and vision, kindles digestion, bestows lustre and beauty, enhances memory and stamina, increases intellect, promotes longevity, is an aphrodisiac and protects the body from various diseases.” (Bhavaprakasha 6.18.1)

Indigenous (Desi) method of Ghee manufacture:

The International Dairy Federation (IDF) has recently drafted a standard for ghee whereby it is defined as a product exclusively obtained from milk, cream, or butter from various animal species, by processes which result in almost the total removal of moisture and solids-not-fat. It must consist of a mixture of higher melting point fats in liquid form. It should contain no more than .3% moisture. Milk fat (mostly glycerides) constitutes 99.5% of the total solids. This IDF standard is being examined for its final acceptance. is the most refined end product of milk. (When you make Ghee, you are concentrating the quality of the milk you started with. This includes, antibiotics, hormones (rGBH), chemical pesticides, etc. It is an age-old process and largely adopted in rural areas/villages and also at urban household levels because of simplicity in equipment and technique. This traditional method of making ghee contributes about 80% of the total ghee produced in the country. This method usually involves two routes:

(1) Lactic acid fermentation of raw or heated milk is followed by churning of curd into makkhan (butter)

(2) separation of malai (clotted cream) from the boiled milk and its churning into butter. Dahi or buttermilk of previous day is used as starter culture for fermentation of milk. Churning of curd or malai is done with hand wooden churn. Now-a-days electrically operated butter churns are available and used by many housewives or makkhan producers.

Makkhan is stored at room temperature for days together and when sufficient quantity accumulated, it is converted into ghee. For this purpose, makkhan is heated in an earthen pot (now-a-days metal, particularly steel or aluminium containers are also used) on slow fire. The scum gathered on the top of melted butter is continuously removed with perforated ladle. The heating is discontinued on complete removal of scum and froth and getting clear fat (ghee). There are several limitations in this process which are mentioned here:

- The quality of ghee is highly inconsistent in terms of chemical and sensory quality.
- Method is incompatible to large-scale production.
- Recovery of fat is low.

- Acidity is high and hence keeping quality is low.
- Manufacture and storage of ghee is done in undesirable containers.
- Ghee residue being acidic in nature cannot be used.

The indigenous method is not adopted by organized dairies. Most of the ghee produced by this method is either consumed for household purpose or serves as a base material for the blending operations at ghee grading and packing centres functioning under Agricultural Marketing and Grading (AGMARK) scheme in India. To overcome the problems associated with desi method an improved indigenous method has been suggested which is as follows:

- Always pre-filter/strain milk before use.
- Give suitable heat treatment, preferably boiling the milk before making dahi.
- Cool milk to room temperature (22-30oC) and then add starter culture for dahi preparation. The setting of dahi should be done under controlled conditions. Incubate milk till dahi is set and desired acidity (0.80 per cent) is developed. It normally requires about 16-18 hrs. In winter and 8-10 hrs. in summer.
- Churn dahi by electrically driven beater or butter churn.
- Use cold water during churning in summer months to minimize the fat losses in buttermilk (lassi), thereby improving the fat recovery in ghee.
- Make ghee preferably from fresh makkhan or store makkhan in a refrigerator if it is to be converted into ghee after a long period. Don't store makkhan or ghee in earthenware or copper or iron containers.
- Heat makkhan (butter) at sufficiently high (more than 100oC) temperature for ghee making.
- Strain ghee properly so as to make it completely free from residue.

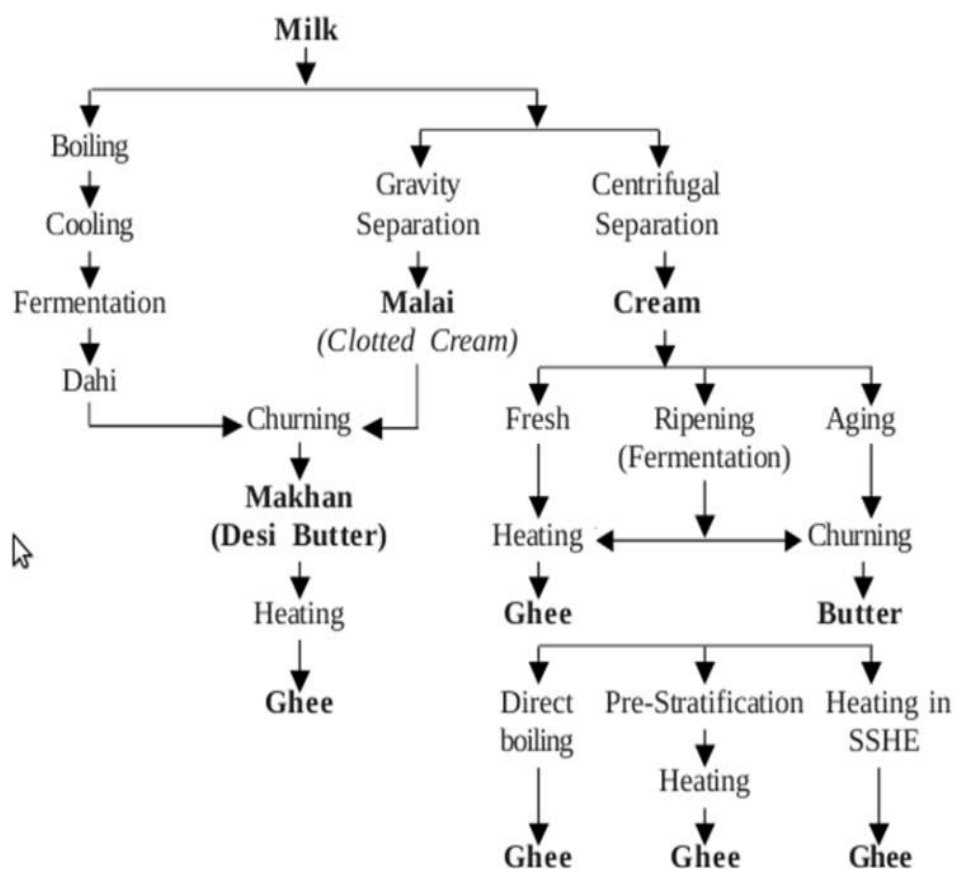
Vedic way of getting butter: On milking a cow gives whole milk. If this milk sits for a while, cream rises to the top. If it is skimmed off, and then churned the fat globules will begin to stick to each other and form butter. What is left over is buttermilk. In the west today, very little butter is churned the old fashioned way. Most modern dairies, even many “organic” ones, no longer churn their cream to make butter. In a typical dairy in America, the cream is now pushed (extruded) through a fine mesh screen in which the heavier and larger molecules of butter are held on one side of the screen while the smaller molecules of buttermilk pass on through. According to the Vedic way of making butter if made without churning- it lacks the quality of fire (Agni). Home-made Indian way of churning their cream with a hand churn, rolling it back and forth between their hands imparts a particular balancing quality to the Ghee – as opposed to the churning by a gear driven. There is one very important difference in the way Ghee was and is made in India. The Indians start out with milk from a cow, just like in the West but they do not let the cream rise to the top and skim it off as in the West. Instead, - they culture the milk with yogurt, allowing it to sit for 4-5 hours, just before it becomes completely soured. Then they churn the whole milk.³

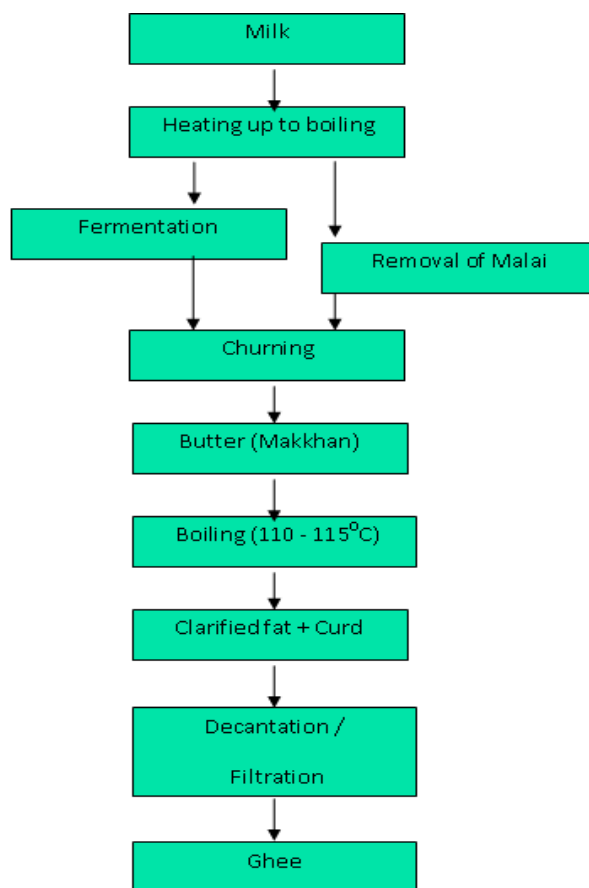
TABLE. Relative merits of different methods of making ghee.

Method	Adaptability	flavour & Texture	Keeping Quality	Vitamins	Economics production
Desi method	Rural Home	Max. Flavour Attractive body and texture	Poor	Absent or trace	No additional cost
Creamery butter method	Industrial	Flat Flavour Ripened cream, better flavor	Good	More than Desi	Costly equip.Labour
Direct Cream method	Industrial	Flat Flavour Ripened cream, better flavor	Excellent	Max.	Costly equip.Labour

Ghee: Its Chemistry, Processing and Technology, N. C. GANGULI and M. K. JAIN, National Dairy Research Institute, Karnal, India, Journal of Dairy Science. Vol 56, No1, 1972.

From that point on, the process is more or less the same. This culturing with yogurt introduces another form of fire (agni) into the substance of refining the milk into butter and then Ghee.





The commercial milk, cream and butter method: Milk is homogenized and pasteurized or ultra-pasteurized (This is a process whereby milk is heated to a higher temperature than pasteurization for a shorter period of time. This kills and destroys various living substances/enzymes in the milk thus prolonging shelf life. Ultra pasteurized milk can keep un-refrigerated for over a month). The effect of this if we are to understand Ayurveda increases the Vata (air and other/destructive, catabolic, drying, rough) qualities in what was originally a very Kapha substance (earth and water, building, oily, tonifying, anabolic) - milk. Some of these processes, like homogenization, make the milk, and thus the cream and butter, indigestible. One of the things you can look for in milk and cream is the sticky quality (**picchila**), one of the gunas of Kapha. It will be lacking in processed milk products.

In the West manufacturers make their butter by extrusion. Furthermore, they homogenize and ultra-pasteurize their milk. Once obtained the butter is heated in a stainless steel or enamel pot, bringing it to a boil. It is said that it is most important to create and enjoy a beautiful and positive environment when you are making Ghee. This subtle recommendation is perfectly in line with cooking Ghee on an open fire - it makes a difference. Similarly, environment can affect Ghee quality. It is better to turn it down to the lowest flame at which it will continue to boil. As it boils, moisture evaporates off it and it will begin to “clarify” - the butter will turn from cloudy yellowish liquid to a more golden colour. Whitish cloudy milk solids will rise to the top and sink to the bottom. After an hour and half to several hours, depending on the amount and the size of the pot and the amount of Ghee compared to the

flame, your Ghee will be ready. The moment Ghee is “ready” is very critical. If you cook the Ghee too little, you will be left with moisture in the Ghee and it will lack the exquisite taste and qualities that it can develop, also, it will tend to spoil or sour. If you cook it too much, it will burn and impart a certain nutty flavour to the Ghee. This does not ruin the Ghee at all, but it is to be noticed, so that over time you can capture the “perfect” Ghee to be experienced between these two “extremes”. After the Ghee is done top light crust of whitish milk solids is skimmed off. These and the heavier ones at the bottom of the pot are traditionally used to make sweets. Children in India love them and always plead with their Mothers to have the leftovers when Ghee is made.

Then, the golden, sweet-smelling liquid is poured through layered cheesecloth - to catch any last impurities into a bottle, leaving the slightly burned milk solids (caramelized lactose) on the bottom of the pot you cooked it in (Ghee has no lactose or milk sugars in it). Be sure to not close the glass jar into which you pour the hot Ghee until it comes to room temperature. The reason for this is that there should not be any moisture from condensation that may form on the inside of the jar. It is moisture that spoils Ghee, allowing a mold to grow and causing it to go bad. This is the reason why clean and dry spoons are to be used take it out of its container. It is also a reason not to refrigerate it. One, because it is not necessary and two, it causes condensation to form inside the jar as you take it in and out of the refrigerator.

Time and Season

It is best to make Ghee on the waxing fortnights of the moon as the moon represents the Mother and nurturing and all the best qualities of milk and butter are energized at this time. Regarding time and season, the quality of Ghee will change as the time of year and the diet of the cows change. Not all milk cows in the West are given green pastures to graze on. Even those, which are allowed to graze in the fields, often do not do so all year round. In winter, there are many days that the cows are not able to go out in the pastures and there is more hay and silage in their diet. This will change the quality of the milk, butter and Ghee. I have noticed that the more the cows graze in the fields on grass, the more yellow is the Ghee. This “yellow” is the result of more chlorophyll in the butter. The making of Ghee is a very beautiful and peaceful experience. The sound of softly boiling butter, the pouring of the thick golden liquid into bottles ... this wonderful smell permeates the air.

Cows and Buffalos

In India, Ghee is made from both Cow and Buffalo milk. If we consider the qualities of both of these animals, we can see why the Ghee of Cows is to be preferred. If we look at the bodies of a Buffalo and a cow, the buffalo is more heavily muscled; it is a denser animal in its makeup. Cows have a more moderate make-up of fat. The Ghee of a Cow is in liquid form at body temperature. The Ghee of a Buffalo is still slightly solid. Buffalo will eat almost any food, even spoiled food, while Cows in their natural environment, will turn away from such fare. Buffalos are often quite dirty and smell more

strongly than Cows. Cows tend to be clean and like little dirt on their bodies. Cows smell quite good as I have experienced, when I stopped to pet and smell them on the streets of India where they roam about, ubiquitously, slowly and peacefully. Finally there is the striking difference in temperament between a Cow and Buffalo. Cows are far gentler in nature. Buffalos are comparatively more stubborn and aggressive. Because of these qualities and more, Buffalo milk and Ghee are considered more dulling (tamasic) while Cow milk and Ghee are considered more pure and purifying (sattvic).

There is a growing use of Buffalo milk and ghee over Cow milk and Ghee, because the Buffalo give more milk. Furthermore, the Indian peasants seek the nourishment of Buffalo Ghee, which has a far higher fat content than cow Ghee. Even in Vrndavan, the home of Sri Krishna, where he himself was a cowherd, protector of the cows (Govinda) and the divine lover of the Gopis, cowherdesses, Buffalo Ghee is omnipresent in the marketplace. You can tell the difference because Buffalo Ghee is white and Cow ghee is yellow.



Ghee is the cornerstone of several cuisines in India. However, little is known about its regional variants.

1. Ghee from Spiti Valley of Himachal Pradesh. At 4,300 metres altitude, Demur in Spiti is one of the highest villages in the world. On the arid, leeward side of the Himalayas, water is a scarce resource and most of the foliage is reduced to shrubs and small trees. People depend entirely on domesticated animals for their survival. Dung from churrus — a local breed of cow-yak — is painstakingly

collected by villagers every day of summer, despite the laborious task of walking up and down the terrace fields, as it is a necessary energy source to keep homes warm in winter. Butter and ghee form a most crucial food source.

2. Milk from churris is collected everyday and poured into a large wooden contraption with a capacity of about fifty litres, to be churned. Roughly once in ten days, the continuously fermenting milk is churned into butter. This butter has all sorts of complexity to it: from the lactic notes of buttermilk, to the more piquant notes of cheese (imagine the aroma of Parmigiano Reggiano), and even the elusive flavours of 2-Heptanone — a flavour compound produced in blue cheese. The ghee made from this butter has a delicious punch.
3. Flavours of the terroir : Just as bees are attracted to the first blossoms of the season, bovines follow fresh grass. The concept is simple — it takes roughly 30 kg of milk to produce 1 kg of ghee. The flavours of the terroir — the wild shrubs, the grasses and flowers — that animals have fertilized and grazed upon, are heightened in this compression, giving the ghee its particular flavour. But let us go back to the beginning. With India's diverse microclimates and dairy breeds, numerous varieties of ghee can be produced. Imagine for a moment, the flavour of ghee from a single cow fed a very specific diet over six months.

The Ghee market comprises of Modern Trade (MT) /Institutional Sales /FMCG Product .Modern Trade involves handling sales through distributors to retail accounts like Big Bazaar, DMart, ABRL, Spencers etc. This also involves direct Cash and Carry accounts like Metro Cash & Carry, Walmart etc. and few independent self-service stores for allocated area. Marketing is done by negotiation and generation of Purchase Order's from local buying managers through team and servicing of PO's in coordination with supply chain for Stocks. Handling Trade Activation for MT Accounts for Merchandising Activities like new launches, Visibility and Promotions conducted at the account level.

The healthy growth of the market can be attributed to numerous forces. Population growth, rising disposable incomes, easy availability, and growing awareness about the benefits of ghee are some of the factors that are broadening the growth aspects of the market.

Manufacturing Processes: The main flavor components of ghee are carbonyls, free fatty acids, lactones, and alcohols. Along with the flavor of milk fat, the ripening of the butter and temperature at which it is clarified also affect the flavor. For example, ghee produced by the clarification of butter at 100 °C or less results in a mild flavor, whereas batches produced at 120 °C produce a strong flavor.

Ghee differs slightly in its production. The process of creating traditional clarified butter is complete once the water is evaporated and the fat (clarified butter) is separated from the milk solids. However, the production of ghee includes simmering the butter, which makes it nutty-tasting and aromatic. A traditional Ayurvedic recipe for ghee is to boil raw milk, let it cool to 110 °F (43 °C). After letting it sit covered at room temperature for around 12 hours, add a bit of dahi (yogurt) to it and let it sit overnight. This makes more yogurt. This is churned with water, to obtain cultured butter, which is used to simmer into ghee. There are 4 common methods through which ghee is prepared. Industrial preparation on the other hand by FMCG companies such as Patanjali Ayurved is done by using "white butter", usually sourced from other dairies and contractors. In the cream butter method, cream is separated from milk and churned to produce butter. The butter then undergoes heat clarification.

1. Milk butter

Sour raw milk is churned into butter. The butter is boiled in an open pan to allow the water to evaporate. The hot ghee is transferred and stored.

2. Direct cream

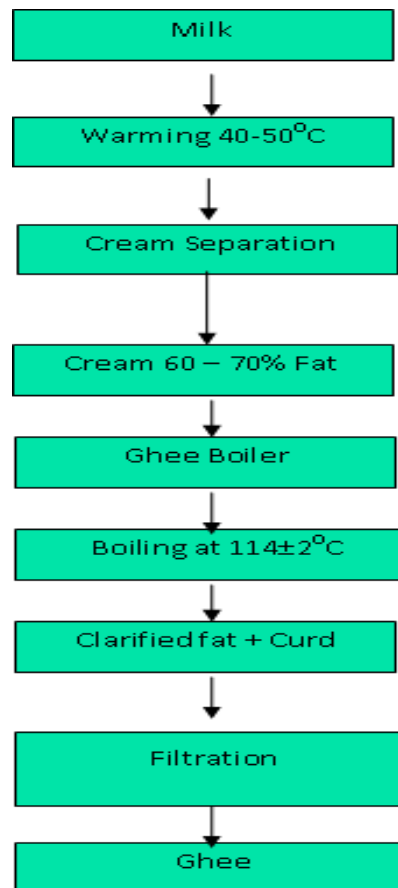
Separation of cream of 60 to 70% fat from milk by centrifugation process, fresh cream or cultured cream is heated to 114±2°C in a stainless steel, jacketed ghee kettle. This kettle is fitted with an agitator, steam control valve, pressure and temperature gauges. A movable hollow stainless tube centrally bored for emptying out the contents or alternatively provision can be made for tilting device on the ghee kettle to decant the product. Heating is discontinued as soon as the colour of the ghee residue turns to golden yellow or light brown. Usually, first plenty of effervescence accompanied by a crackling sound in the preliminary stages of boiling but both gradually subsides when the moisture content decreases. When almost all the moisture is evaporated, the temperature of the liquid medium suddenly spurts up and care has to be exercised at this stage to control the heating. The end point is indicated by the appearance of second effervescence, which is subtler than the first one accompanied by the browning of curd particles. At this stage the typical ghee flavour emanates and this indicates that the final stage in the preparation of ghee.

Advantages of this method are

1 No need for butter production prior to manufacturing of ghee.

Limitations

1. Long heating time to remove the moisture.
2. High content of serum solids in the cream may also produce a highly caramelized flavour in the ghee.
3. 4 – 6% loss of butter fat in the ghee residue & during the handling operations.
4. So, 70 – 80% fat cream is recommended to minimize both fat loss and steam consumption



Creamery Butter Method This is the standard method adopted in most of the organized dairies. Unsalted or white butter is used as raw material. Butter mass or butter blocks are melted at 60°C to 80°C in butter melted. Molten butter is pumped into the ghee boiler where final heating will be done using steam as heating medium. Increase the steam pressure to raise the temperature. Scum which is forming on the top of the surface of the product is removed from time to time with the help of perforated ladle. Moment of disappearance of effervescence, appearance of finer air bubbles on the surface of the

fat and browning of the curd particles indicates to stop heating. At this stage typical ghee aroma is produced. Final heating temperature is adjusted to about $114\pm 2^{\circ}\text{C}$. To get the cooked flavour, heating beyond this temperature is also being in practice. Ghee is filtered via oil filter into the settling tank.

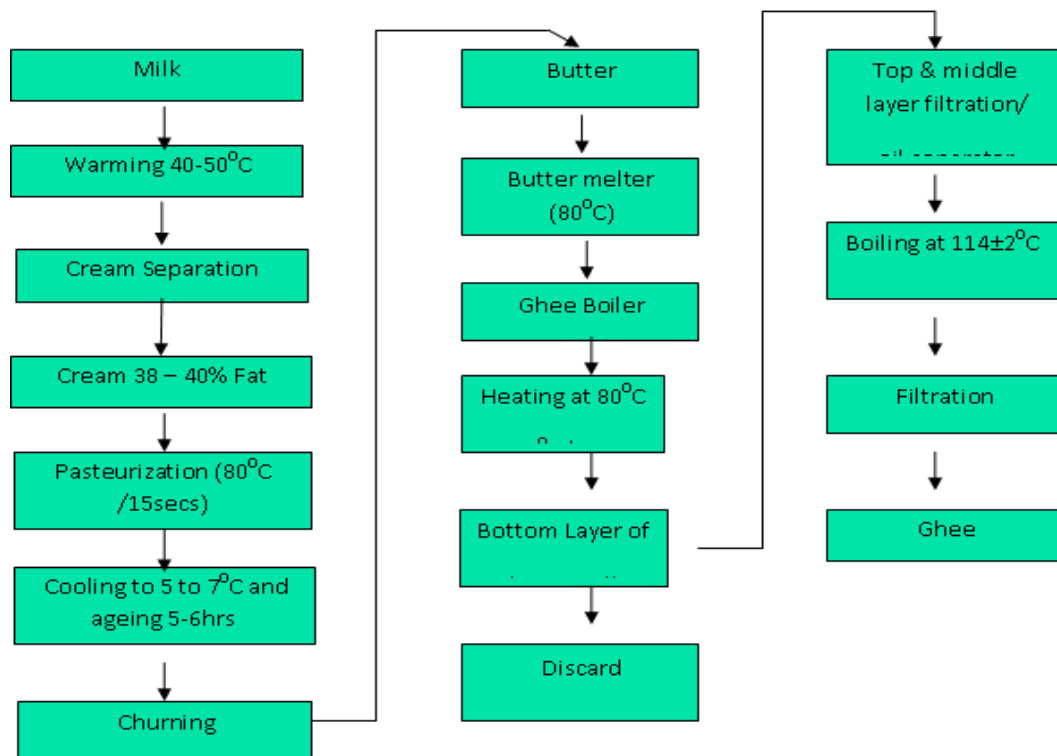
1. Pre-stratification

Butter is produced from aged cream of 38 to 40% fat using continuous butter making machine or batch churn. Butter is then transferred to butter melter, and melt at 80°C . This molten butter is kept undisturbed in a ghee kettle or boiler at a temperature of $80\text{--}85^{\circ}\text{C}$ for 30 min. Here, in ghee kettle, stratification of mass takes place, product stratifies into 3 distinct layers. Denatured protein particles (curd particles) and impurities are collected on top layer and floats on surface. Middle layer consists of clear fat and bottom layer consists of buttermilk serum carrying 80% of moisture and 70% of solids-not-fat contained in butter.

The bottom layer is then carefully removed without disturbing the both top and middle layers. Middle layer, largely consists of fat is heated to $114\pm 2^{\circ}\text{C}$ along with top layer of floating curd particles and denatured protein. This step is necessary to develop characteristic ghee aroma. Milder flavour ghee can be produced, since most of the curd content is removed before final clarification temperature of ghee.

Advantages of pre-stratification method

- * Removal of buttermilk (bottom layer) eliminates prolonged heating for evaporation of the moisture
- * Formation of significantly low quantity ghee residue
- * Low quantity of ghee absorbed into ghee residue so less fat loss along with ghee residue
- * Production of ghee with lower FFA and acidity



Continuous Method: This method was developed to meet the requirement of high volume production and to overcome the limitation of batch method. Limitations of batch method are as follows:

- * Requires high energy, due to low heat transfer co-efficient
- * Cleaning and sanitation of equipments, not satisfactory
- * Equipment and process unsuitable for large volume of production
- * Floor becomes slippery due to ghee spillage
- * Handling losses are more

Benefits;

- * Better control on quality of the product
- * only small hold-up of raw material in the plant at any time and hence no chance for whole batch getting spoiled
- * Contamination by handlers can be eliminated
- * CIP can be possible
- * No foaming of the product during production

Butter is heated in a butter melted to molten state and then transfer into balance tank, and pumped further to scraped surface heat exchanger(SSHE), followed by flashing in vapour separator. And this heating in SSHE 'Scraped Surface Heat Exchanger' and flashing are repeated in next two stages to reduce the moisture level. Ghee is then pass through centrifugal clarifier where residue will be removed. Clarified ghee is stored for filling and packing. The dynamic scraped surface heat exchangers incorporate an internal mechanism which periodically removes the product from the heat

transfer wall. The product side is scraped by blades attached to a moving shaft or frame. The blades are made of a rigid plastic material to prevent damage to the scraped surface

Granulation and Cooling of Ghee

Granulation is important criterion of quality; higher temperature of clarification gives better grain size due to high phospholipids content. Completely melted ghee on cooling to prevailing Indian temperatures, can assume the form of large, coarse grains suspended discretely or in clusters in a liquid phase. The process of crystallization is initiated with the formation suitable nuclei. Rate of cooling strongly influences the rate nucleus formation. Stirring or agitation and seeding (at the rate of 1 – 3%) encourage the nucleus formation. For better granulation, ghee should be slowly cooled to 28°C in 2-3 hours' time and agitation is required during granulation to form smaller granules.

Causes of granulation: The partly granular form assumed by ghee is primarily due to certain content of glycerides of higher melting saturated fatty acids, especially palmitic & stearic. Thus buffalo milk ghee show predominant granulation than cow milk ghee.

Yield: The yield of ghee from cream or butter is influenced by fat content of raw material. Factors which influence the yield are listed below.

Following factors influence the yield of ghee,

1. Method of production: The fat recovery in indigenous method is lowest in range of 80-85% in creamery butter method it ranges from 88-92% and highest in direct cream method ranging from 90-95%.
2. The fat content of the raw material used: Higher the fat content higher will be the yield and vice versa.
3. Quality of milk or cream: If the acidity of milk or cream intended to use in ghee production is higher than fat losses in ghee residue will be higher, thus it reduces the yield.
4. Fat recovery from ghee residue: Scientific reports suggest to extract as much as fat from ghee residue by dissolving ghee residue in hot water followed by filtration and centrifugation. By this method, it is possible to extract the fat from ghee residue and that fat can be added back to cream or melted butter.

Packaging

Ghee may be packaged in airtight glass jars and stored without refrigeration.

Ghee is generally found to be packaged in airtight glass jars. They should be kept away from direct sunlight as sunlight can cause moisture to build inside the jar. Moisture can cause deterioration to the ghee's quality as well as reduce its shelf life. To prevent the acceleration of the oxidation process, they should be protected from anything that causes it, such as UV rays from the sunlight and fluorescent lights. If the jar is unopened, it does not need to be refrigerated as long as the previously mentioned conditions are met. Once opened, they can be stored in a kitchen cabinet for up to 3 months. Afterwards, it may be left in the refrigerator for up to a year. The refrigerator causes ghee to harden but if it is left at room temperature for a while, it will soften up again.

Composition

Ghee may be made of milk from various domesticated ungulates, such as cows and sheep. The composition of ghee varies depending on the animal whose milk has been used. The vitamin A content ranged from 315 to 375 international units per 100 grams. Palmitic acid and oleic acid were two of the main fatty acids found in both cow and sheep ghee. The saturated fatty acid profile was 53.9 to 66.8 percent, the unsaturated fatty acid profile was 22.8 to 38.0 and the other fatty acids was 3.5 to 10.4. Cholesterol amounts ranged from 252 to 284 mg/100 grams.

Market Summary:

The global ghee market grew at a CAGR of 3.9% during 2011-2018 reaching a volume of 5.9 Million Tons in 2018 and is expected to reach INR 4,653 Billion by 2024. Population growth, health benefits, increasing disposable incomes and penetration in newer markets currently represent some of the key factors driving the demand of this product. The Indian market to be specific, is segmented on the basis of types into cow and buffalo ghee.

- The market is divided on the basis of the co-operative and private sector. At present, co-operatives represent the largest segment.
- The market has been categorized according to retail and institutional sales. Currently, retail sales account for the majority of the market share.
- On the basis of packaging, the market is segregated into 1kg, 0.5 Kg and 10-15 Kg. Amongst these, 1kg packaging is the most popular segment.
- The regional outlook of the market has been analysed across fifteen major states, namely, Karnataka, Maharashtra, Tamil Nadu, Delhi, Gujarat, Andhra Pradesh and Telangana, Uttar Pradesh, West Bengal, Kerala, Haryana, Punjab, Rajasthan, Madhya Pradesh, Bihar and Orissa.

Amongst these, Uttar Pradesh represents the largest market followed by Rajasthan and Madhya Pradesh.

- The competitive landscape of the market has also been examined with some of the key players being Gujarat Co-operative Milk Marketing Federation Ltd., Mother Dairy Fruits and Vegetables Pt. Ltd., SMC Foods Limited, Bhole Baba Dairy Industries Ltd., Rajasthan Cooperative Dairy Federation Ltd (RCDF) and Parag Milk Foods Ltd.

Preservation: In India, preservation of milk and milk products is primarily achieved by heat induced desiccation. Ghee is obtained by clarification of milk fat at high temperature. Ghee is almost anhydrous milk fat and there is no similar product in other countries. It is by far the most ubiquitous indigenous milk product and is prominent in the hierarchy of Indian dietary. Being a rich source of energy, fat soluble vitamins and essential fatty acids, and due to long shelf life at room temperature (20 to 40C), 8070 of ghee produced is used for culinary purposes. The remaining 2070 is used for confectionery, including sma/l amounts consumed on auspicious occasions like religious ceremonies (22). Since buffalo milk constitutes more than 5570 of the total milk production in India and because of its higher fat content (6-770), ghee is manufactured mostly from buffalo milk. Due to lack of carotenoids in buffalo milk, ghee prepared from milk is white unlike cow ghee which has a golden yellow color. Because of its pleasing flavour and aroma, ghee has always had a supreme status as an indigenous product in India.

Physicochemical Characteristics: Chemically, ghee is a complex lipid of glycerides (usually mixed), free fatty acids, phospholipids, sterols, sterol esters, fat soluble vitamins, carbonyls, hydrocarbons, carotenoids (only in ghee derived from cow milk), small amounts of charred casein and traces of calcium, phosphorus, iron, etc. It contains not more than .370 moisture. Glycerides constitute about 9870 of the total material. Of the remaining constituents of about 270, sterols (mostly cholesterol) occur to the extent of about .5~. Ghee has a melting range of 28 to 44 C. Its butyl refractometer reading is from 40 to 45 at 40 C. The saponification number is not less than 220. Ghee is not highly unsaturated, as is evident from its iodine number of from 26 to 38. The Reichert-Meissl number (RM) of cow ghee varies from 26 to 29 whereas goat ghee is slightly less. Sheep and buffalo ghee on the other hand, have higher RM numbers of about 32. In general, ghee is required to have a RM number of not less than 28. It is, however, of interest that ghee from milk of animals fed cotton seeds has much lower RM numbers of about 20. Polenske number for cow ghee is higher (2 to 3) than buffalo ghee (1 to 1.5). No significant seasonal variations have, however, been recorded for their fat con- scants. The fatty acid profile of glycerides of ghee is very complex and still not completely elucidated. Layer formation is typical in ghee if stored above 20 C.

Preparation: Ghee making in India was and is mostly a home industry; particularly in villages where an estimated 60% of India's population lives. According to the 2011² census of India, 68.84% of Indians (around 833.1 million people) lived in 640,867 different villages. The size of these villages varied considerably. 236,004 Indian villages have a population of fewer than 500, while 3,976 villages have a population of 10,000+. Substantial amounts of Ghee comes from villages where it is usually prepared by the desk method. Recently, industry has manufactured improved ghee of more uniform quality. However, it still constitutes only a small fraction of the total annual production (450,000 metric tons) in India.

As mentioned earlier, ghee is prepared by four methods, namely, desi, creamery butter, and direct cream and pre-stratification methods. The essential steps involved in the preparation of ghee by these methods are outlined in Figures 1 to 4 (6, 15). Basically, the high heat applied to butter or cream removes moisture. Both are usually clarified at 110 to 120 C. However, in southern India clarification is at 120 to 140 C. The desi method consists of churning curdled whole milk (dahi) with an indigenous corrugated wooden beater, separating the butter, and clarifying it into ghee by direct open pan heating. Earthenware vessels are used to boil milk and ferment it with a typical culture to convert it to dahi which in turn is churned to separate the butter. The creamery butter and direct cream methods are more suitable for commercial operations because less fat is lost. Direct cream method is reportedly most economical for preparing ghee and the product has better keeping quality. In the pre-stratification method, advantages such as economy in fuel consumption and production of ghee with low acidity and comparatively settled portion, However, this method has not been adopted by industry. Desi method accounts for more than 97% of ghee manufactured. However, with industrial interest, the creamery butter and direct cream methods are increasing. The continuous ghee making equipment which is more sanitary was fabricated at the National Dairy Research Institute at Karnal. ⁴ consisting of a three-stage pressurized, swept surface separator.

The physicochemical characteristics of ghee are determined by:

1. type of animal feed
2. milk, or cream produced by the cow
3. dahi or butter
4. methods of preparation
5. temperature of clarification
6. storage conditions

The principal measurements of ghee quality are: peroxide value, acidity, and flavor.

Peroxide value and acidity. The quality of ghee on storage has been measured by acid and peroxide values. However, peroxide value varies considerably at the organoleptic threshold of rancidity. Though the thiobarbituric acid value (TBA value) is a more reliable.

Index of oxidative rancidity of ghee. TBA value of buffalo ghee was always higher than that of cow ghee.

Flavor. The most important factor controlling the intensity of flavor in ghee is the temperature of clarification. Ghee prepared at 120°C or above has an intense flavor which is usually referred to as cooked or burnt. In contrast, ghee prepared at around 110°C has a somewhat mild flavor, often referred to as curdy. The desi method generally produces ghee with the most desirable flavor.

The acidity of the cream or butter affects the flavor of ghee. Sweet cream-butter yields ghee with a flat flavor whereas cream or butter having an acidity of 0.15 to 0.25% (lactic acid) as in ripened cream-butter, produces ghee with a more acceptable flavor.

However, the rate of deterioration in the market quality of ghee is least in ghee from unripened cream-butter and most in that prepared from ripened cream-butter. The flavor of stored ghee is influenced by the method of preparation and by temperature of clarification. In ghee made at 110°C, the original flavor is maintained for several months, but once deterioration begins, market quality is lost quicker than in ghee prepared at the higher temperatures of clarification. Flavor in ghee is retained longer when butter contains 1% NaCl. There is a general similarity in the gross patterns of volatile carbonyls isolated from differently produced ghee. Of the 11 carbonyls in most of the ghee produced, six have been tentatively identified as propanone, butanone-2, pentanone-2, heptanone-2, octanone-2 and nonanone-2. Small but significant differences in the quality and quantity of volatile carbonyls in different types of ghee have been reported.

The use of **ripened cream butter** in the preparation of ghee improves the flavor, but the impact on the pattern of carbonylic compounds in ghee appears to be less marked. About 95% of the carbonyls in ghee are non-volatile. Cow ghee contains more volatile carbonyls. The total carbonyls of buffalo ghee is higher than that of cow ghee irrespective of the method of preparation and temperature of clarification.

The ketoglycerides constitute 50 to 60% of the total carbonyls in ghee, buffalo ghee (4.4 μ moles/g) having a higher proportion than cow ghee (2.4 μ moles/g). Oct-2-enal and dec-2-enal are the main alk-2-enals in the volatile as well as monocarbonyls in ghee. The patterns of alkanals from cow and buffalo ghee are similar and consist of ethanal, pentanal, hexanal, heptanal, octanal, nonanal, decanal, undecanal and dodecanal.

Changes on Storage Ghee undergoes physio-chemical changes, dependent primarily on the temperature of storage. Crystallization occurs with the formation of solid, semi-solid and liquid layers. Ghee (cow and buffalo) kept either in a metal or glass container at 20 C or below, solidifies uniformly with fine crystal (3). Above 20 C and below 30 C, solidification is a loose structure. The liquid portion had a significantly higher RM number than the granular solid or hard flaky portion of the same ghee. A similar trend in the iodine number in these layers also occurs. It is preferable to store ghee below 20 C to avoid layer formation. Ghee stored at high temperature is also susceptible to oxidative deterioration, rancidity, and off flavor. Due to inadequate storage facilities in India, much ghee loses its market acceptability. Shelf life of ghee is also dependent on the method of preparation. The keeping quality of desi ghee is better than that of direct cream or creamery butter ghee. It has been claimed that milk phospholipids in ghee improves its shelf life. Ghee having more residue, which is a source of phospholipids, has a longer storage life.

Earlier, **packaging of ghee** was permitted ordinarily in 17, 4, 2 and 1 kg tinned cans (1). Excepting 17 kg cans, others must contain the net weight of ghee, e.g. 4, 2, or 1 kg. Permission is also given to pack ghee in 1 kg and half kg return- able glass bottles. Special permission of the Agricultural Marketing (Agmark) Adviser to the Government of India is necessary for pack- ing in any other size package. Most ghee is marketed in 4-gallon tin con- tainers. Cans are filled to brim with no air space to improve storage quality. Anti- oxidants like butyl hydroxyl anisole (BttA) are permitted to prolong shelf life.

The flow diagram of the above methods has been schematically shown in Fig.

In a Nutshell: Ghee vs. butter

Because ghee and butter both derive from cow's milk, their nutritional profiles and fat content are very similar. However, because ghee does not contain the same levels of dairy proteins as butter, it may be better for people who do not tolerate dairy products well.

Benefits and risks of ghee

Various research studies have looked at the possible benefits and risks of including ghee in a person's diet. These include:

a. Heart disease. According to research from 2010 Trusted Source, ghee contains almost 50 percent saturated fat, which has led to concerns that ghee might increase the risk of coronary artery disease (CAD) in India. However, a 2018 study looking at 200 people in north India suggests that the fat and cholesterol in the blood was healthier in the people who ate more ghee and less mustard oil as

sources of fat in their diets. Results included lower LDL or bad cholesterol levels and higher HDL or good cholesterol levels. This study only compared results between ghee and mustard oil and not butter. Some forms of mustard oil are banned for consumption in the United States, Canada, and Europe because they contain erucic acid.

b. Lower levels of milk sugars and proteins

Because ghee has had many of its dairy proteins removed, it contains much lower levels of dairy proteins, such as casein, and lactose than regular butter. A person who is sensitive or intolerant to lactose and casein may find that it is beneficial to use ghee as a substitute for butter.

c. Contains butyrate

Ghee contains a fatty acid called butyrate acid, which plays an essential role in digestive health. It may also have anti-inflammatory effects. However, as butyrate is produced by bacterial fermentation of fiber in the colon, a person does not need to consume saturated fat to obtain this. According to the United States Department of Agriculture (USDA), real butter does not contain any trans fats. However, it does contain high levels of saturated fat, which can contribute to high blood cholesterol levels and heart disease if not eaten in moderation. The American Heart Association recommends that a person should get no more than 5 to 6 percent of their total daily calories from saturated fat, which is about 13 grams per day. However, fats are essential for a healthful diet. A person should limit their intake of saturated fats and increase their intake of monounsaturated and polyunsaturated fats, which are healthful fats.

Good sources of healthful fats include fish, nuts, seeds, and olives.

Conclusion: Ghee is another form of butter, and the nutritional profile and fat content of the two are similar. However, ghee may be better for people who are sensitive to lactose and casein because it contains less of both. While ghee and butter should be limited, a person can occasionally include both foods in a varied and balanced diet.

Nutrition / Diet

1. "The milk of cows is considered to possess the essence or sap of all plants and Ghee is the essence of milk... When we consider Ghee we are in the company of superlatives. In India, Ghee has been so highly regarded for so many things, for so long, that one is slightly embarrassed to enter into this crowded river of praise.
2. The ingestion of Ghee is like offering the finest of fuels into the fires of digestion (Agni). In accord with this, Ghee builds the aura, makes all the organs soft, builds up the internal juices of the body (Rasa) which are destroyed by aging and increases the most refined element of digestion (Shukra or Ojas) the underlying basis of all immunity and the "essence of all bodily tissues".

3. Maya Tiwari- humanitarian, world peace leader and author. Also called "Mother Maya," an international teacher of Ayurveda, a health activist and the founder of the Wise Earth School of Ayurveda calls- Ghee the “single most “ojas” producing food on earth.”
4. Ghee is known to increase intelligence (Dhi) refine the intellect (Buddhi) and improve the memory (Smrti).
5. Although Ghee kindles or increases the digestive fire (Agni) on which all nutrition depends, it does so without aggravating Pitta - the elemental functioning of fire within the body. In fact, Ghee cools the body, essential in much of today’s world in which everything is overheating.
6. Ghee causes secretions and liquification in the dhatus - bodily tissues - that dissolve wastes allowing the functional intelligences of the body (doshas) to carry away toxins (Ama) (also known as aam). The ingestion of Ghee is used in Panchakarma specifically to first penetrate into and then dissolve ama in the dhatus, allowing the wastes to be then carried to the intestinal tract and then expelled.
7. It is traditionally considered, that the older Ghee is, the better its healing qualities. 100-year-old Ghee is highly valued in India and fetches a very high price. Such Ghee was often kept in Temples in large vats and families often pass on aged Ghee to their next generation to be used as medicine.

8. Qualities of Ghee

- I. Ghee is known as a substance that gives longevity... This is because it has opposite qualities (heavy, slow, oily, liquid, dense, soft), and thus pacifying effects, to the light, dry and rough qualities of Vata dosha. It is the increase of the qualities of Vata that are synonymous with aging.
- II. Ghee, in a very sure and steady way, slows the aging process by balancing the living one.
- III. Ghee has the quality of snigda, oiliness, and unctuousness. It is smooth, lubricated and nurturing. Ghee is thought to make the voice soft and melodious.
- IV. Ghee is Guru, heavy. It increases the qualities of Kapha and decreases Pitta and Vata, which are both light.
- V. Ghee has the quality of Mrudu, softness. Ayurvedic panchakarma treatments use Ghee as oil used on eyes. In Netra Basti, a small dam is built around the eyes and filled with warm Ghee. Then, you open your eyes to its soothing softness. It seems after that treatment, that you see the world through a soft diaphanous curtain of love and loveliness.

9. Healing Properties of Ghee

In ancient India, wells full of Ghee were especially for those who suffered wounds. When a surgeon cuts open a body, he only does so knowing that the body will be able to heal itself. The surgeon cannot

do this. Ghee is known for the quality of Ropana - healing, and its effectiveness in facilitating recovery from wounds. In Ayurveda, when a person has a chronic peptic ulcer or gastritis, Ghee is used to heal that ulcer inside the intestinal tract.

- a. Ghee works wondrously on bedsores for the elderly or debilitated. It can be applied for broken bones and bruises. It is highly effective for all sorts of skin rashes. It is also used on burns of both fire and chemicals.
- b. Those with obesity should be very frugal in their use of Ghee and those with high cholesterol should not take Ghee at all.
- c. Ghee increases the overall strength, luster and beauty of the sarira – the body. Let us look at a variety of ways:
- d. Used on the skin, Ghee softens and strengthens, protects and nourishes. Up until the last generation in India, there used to be men who gave Ghee massages on the street. It was always the preferred substance for the skin, but since it was more expensive than oil it has come to be used only for internal purposes. For generations, Indians have used Ghee for cooking and as an added measure on top of their food and as a medicine.
- e. In India, medicinal ghee is passed on from one generation to the next. It was used for old and young, for new babies (Mothers in India will massage their children with Ghee) and for those in the last days of their life. I massaged my Father's body with it before he died - He loved it. Sometimes, when he could not sleep, I rubbed it on his feet and temples and it soothed his agitation. It is considered one of the best substances for self-massage (Abhyanga).

10. Many Uses of Ghee

1. For Body Massage-Abhyanga. Apply ghee all over the body, rubbing into head, chest, limbs, joints and orifices. This will bypass the digestive system and allow the qualities of Ghee to penetrate directly into the deeper tissues. It is said that 60% of what is placed on the skin is absorbed into the body. We literally “eat” what we put on our skin. Western science has discovered that massaging the skin creates endorphins or peptides, which enhance the body's immune system. Peptides are thought to be the vehicle that the mind and body use to communicate with each other, a literal chemistry of emotion. According to the Charak Samhita, regular Abhyanga slows the aging process.
2. Ghee is used in Purvakarma (early Panchakarma) where a small amount of Ghee is taken first thing in the morning by the practitioner to oleate the internal organs and “dissolve” the ama or toxic wastes in the tissues, allowing them to be carried to the digestive tract for elimination.
3. Ghee is used as a carrier or “yogavahi” for herbs and bhasmas because of its supreme penetrating qualities and thus ability to carry these substances deep into the dhatus or tissues. One or two teaspoons first thing in the morning followed immediately with hot water will promptly produce a bowel movement. It will also warm the body quickly. Two spoonfuls

of Ghee in warm (non-homogenized) milk before bedtime is soothing to the nerves and lubricates the intestines and facilitates a bowel movement in the morning.

4. Ghee is excellent for cooking and sautéing or stir-frying. Ghee has one of the highest flash points of all oils and is very difficult to burn. In India, it is said that food is incomplete without the use of Ghee.
5. Ghee is excellent for a gargle (gandush) to improve the health of the teeth and gums.
6. Ghee can be used as a bath oil. Take two tablespoons of Ghee and mix with several drops of an essential oil of your choice.
7. Ghee is excellent for scrapes and both chemical and heat or fire burns.
8. Ghee can be used in the eyes for tiredness or fatigue.
9. Ghee is an exquisite facial moisturizer.
10. In India it is said that if a few drops of ghee are placed in the nostrils then nosebleed can be checked. If this is done twice in a day, then headache can be relieved.

On ghee, the Indian superfood



MORE-IN

METROPLUS

Prabalika M. Borah prabalika.m@thehindu.co.in

The desi favourite has made a comeback on dinner plates of gourmands and health nuts alike

Another *desi* ghee recipe? Whether you're Paleo, Keto or simply chugging back Bulletproof coffee every morning, if you lurk around the Wellness web, you will inevitably stumble upon multiple fitness coaches gushing about the benefits of ghee. And a plethora of voices, from New York to Nairobi, asking for the recipe.

"Ghee is pure butterfat and is also called butter oil, because it is made after clarifying butter," explains Sangeeta Khanna, a food writer, patiently explaining the procedure. "It comes from milk fat. And can be of two types: uncultured ghee made by skimming all fat from whole milk, or the more common

cultured ghee that is made in most Indian homes. For this, the cream is collected over a period of time and cultured with a little yoghurt. It is whipped into butter, which is then heated and made into ghee.”

If you prefer to buy your ghee, Amazon alone lists about 300 options, starting from ₹75 to a 15-litre tin of Shree Radhey Certified A2 Gir Cow Ghee for ₹14,300. The variety is fascinating: ghee made from forest cows, indigenous cows and buffaloes. You can source your ghee from Uthukuli, famous for its milk, or from a *gaushala*. Of course, much of the small-batch ghee is grass-fed, hand-churned and artisan. But that’s not all. Vrindavan milk even has a version that is hand-churned, made on a full moon night on a cow dung fire following a traditional “*vilona bilona* method (alternate direction churning)”. The rest of the world is following suit. American supermarkets focus on ghee made from the milk of grass-fed cows (as opposed to cows raised on grain-based feeds with soy and corn, which may contain GMOs). LA-based artisanal food brand Fourth & Heart, which specialises in ghee, offers what they call “Himalayan Pink Salt Grass-Fed Ghee Butter... Pasture Raised, Non-GMO, Lactose Free,” in addition to Madagascar Vanilla Ghee, Californian Garlic Ghee and even — hold your breath — a Chocti Chocolate Passionfruit Ghee Cacao Spread.

Closer home, “Serve it hot with a spoonful of ghee” is how many Indian recipes conclude, conjuring up that familiar flavour and aroma. Once associated with the decadence of *laddoos*, *halwa* and *puran poli*, today, thanks to a slew of young nutritionists and increasingly media-savvy Ayurvedic spas, it’s become India’s favourite health food.

Blame game

And if there is anyone who still blames ghee for their weight, take a look at Kareena Kapoor Khan, who’s proclaimed her weight loss secret: dal, rice and ghee.

“The properties of ghee are constant, provided one is consuming the right kind. Grandmoms routinely recommend it for children and they would not have done so had it been harmful,” says Chef Kunal Kapoor. He talks about how ghee is one of the earliest cooking mediums, dating back thousands of years. Neutral oils are the resultant of what man discovered once he began to cultivate crops. “When cooked in ghee, both meat and vegetables taste better,” he says, cautioning that the superfood can also be counterproductive if consumed indiscriminately. He adds, “Ghee isn’t the culprit, it is our lifestyle and the quantities we consume that are a problem. Any superfood can go against us, if we do not lead an active life.”

Lifestyle matters

Celebrity dietician and author, Rujuta Diwekar, has brought joy to many by giving ghee a superfood tag. In her book *Indian Super Foods*, Rujuta says, “The reason why there are such combos as *dal-chawal-ghee*, *roti-shakkar-ghee*, *puran-poli ghee*, *modak-ghee* etc in our culture is that ghee reduces

the glycaemic index of these meals. The magic of ghee isn't just that it's the world's most high-functioning fat. It's also that it's a wonderful partner to other foods, complementing them to work better and harder for us."

Promoted by influencers like her, ghee now has great market potential. However, as brands proliferate, consumers need to be able to identify pure ghee from the inevitable, cheap adulterated versions also flooding the market.

"Pure ghee doesn't have an overpowering smell or flavour. Neither is it neutral in taste. This remarkable anti-ageing food, when adulterated with hydrogenated or animal fat, becomes a dangerous substance," cautions Ayurveda practitioner, Sharad Kulkarni. He adds that besides several beneficial properties, pure ghee comes with a unique advantage: "Ghee is *samskara anuvartana*, which means it retains its own goodness along with the health benefits of whatever it is cooked with," he explains. He adds that, according to Ayurveda, the food can improve your skin, memory and strength. It helps you detox and is even a centuries-old aphrodisiac."

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